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Hou et al.

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(54) **KEYBOARDS**

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Feb. 2, 2007 (TW) ..... 96103849 A

(51) **Int. Cl.**
H01H 13/70 (2006.01)

(52) **U.S. Cl.** **200/512**; 200/517; 200/341

(58) **Field of Classification Search** ..... 200/5 R, 200/5 A, 511–517, 341, 345; 341/22; 345/156, 345/168, 169, 172; 400/472–496
See application file for complete search history.

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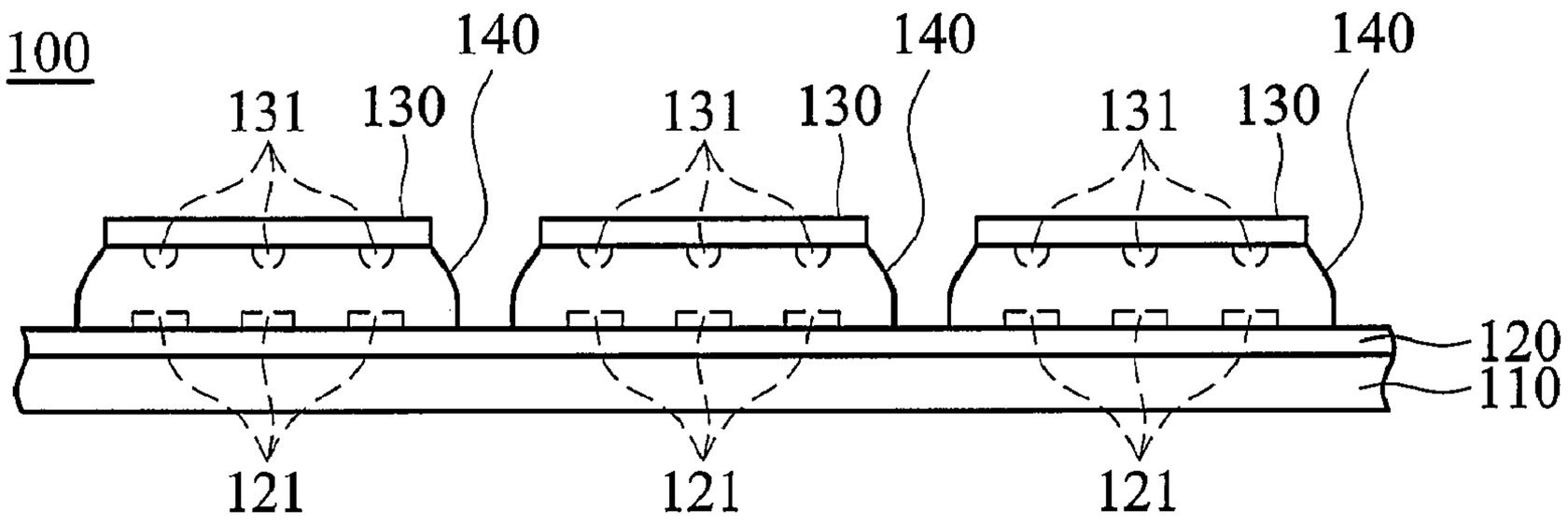
(57) **ABSTRACT**

A keyboard. A membrane circuit board includes a plurality of switches. At least one keycap is disposed on the membrane circuit board and includes a plurality of activating pillars respectively corresponding to and separated from the switches. When the keycap is moved toward the membrane circuit board, one of the activating pillars compresses one of the switches, outputting a signal corresponding to the keycap.

18 Claims, 4 Drawing Sheets



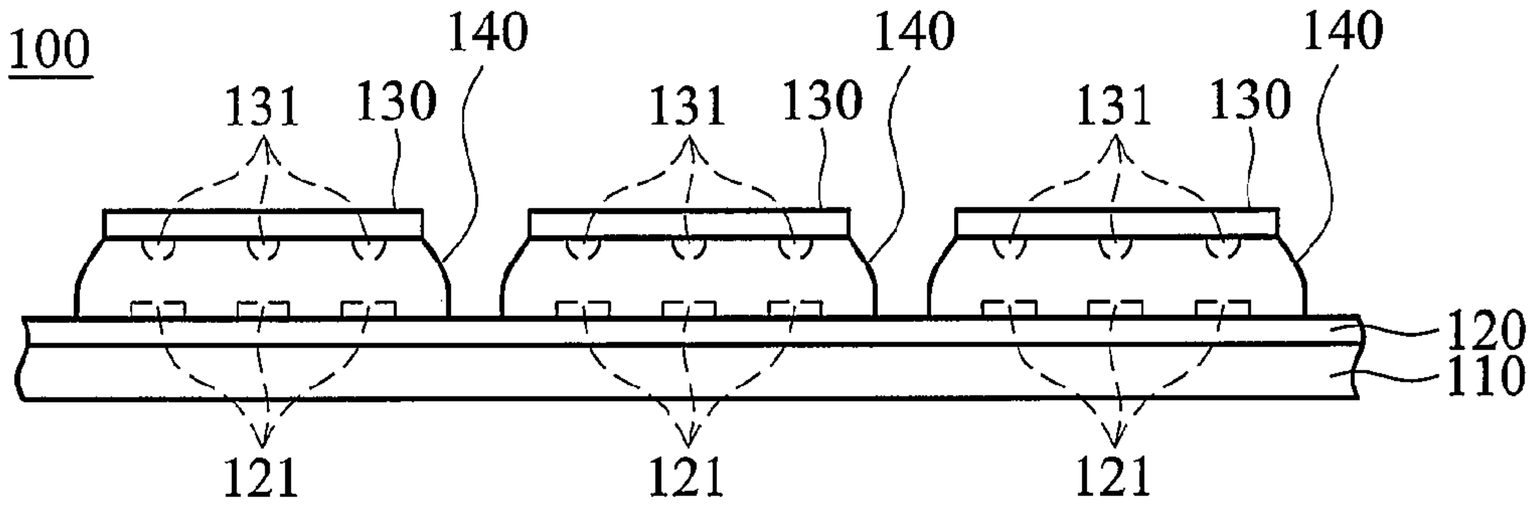

100
140
140
140
131
130
131
130
131
130
120
110
121
121
121

FIG. 1A

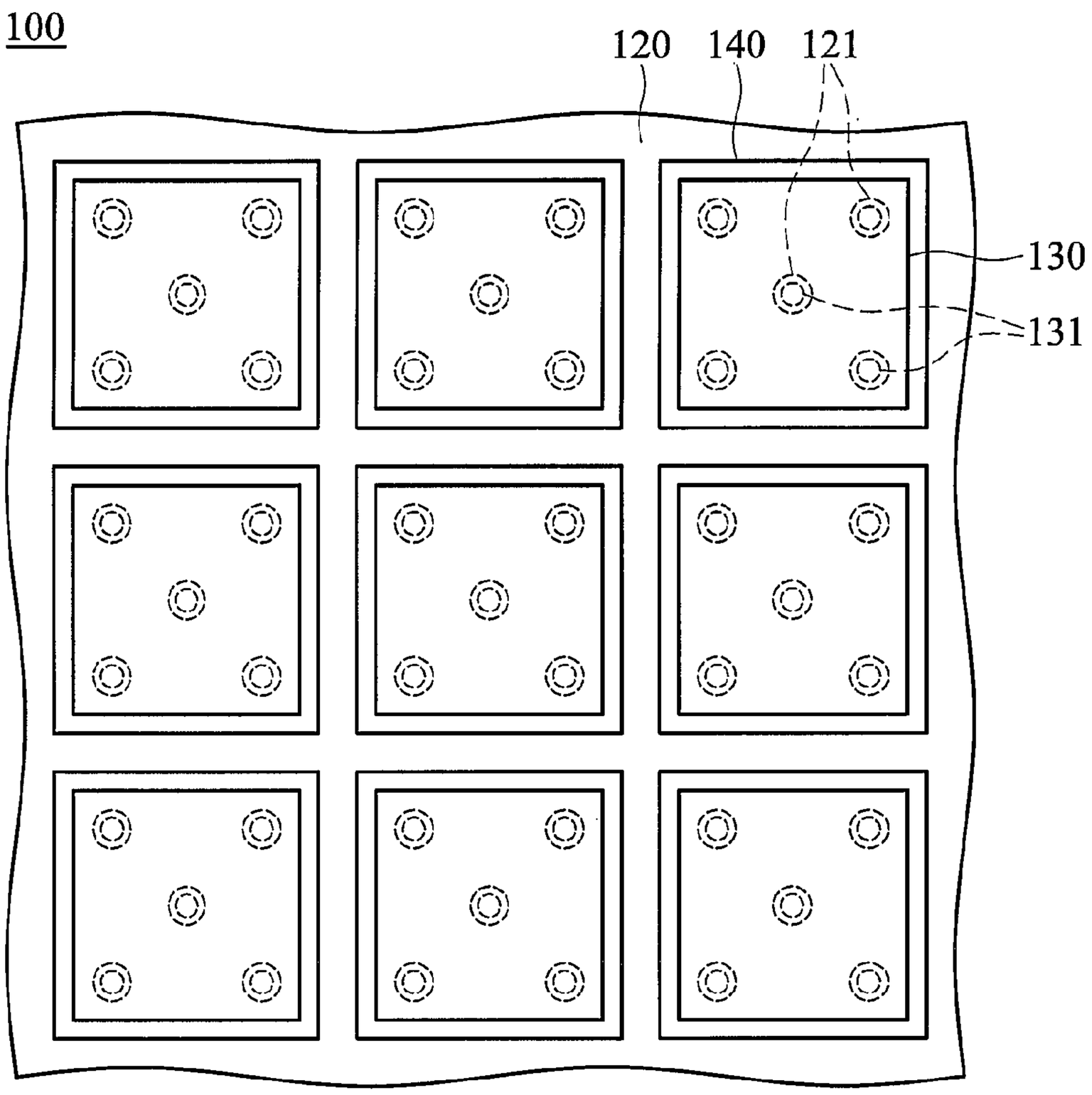

100
120
140
121
130
131

FIG. 1B

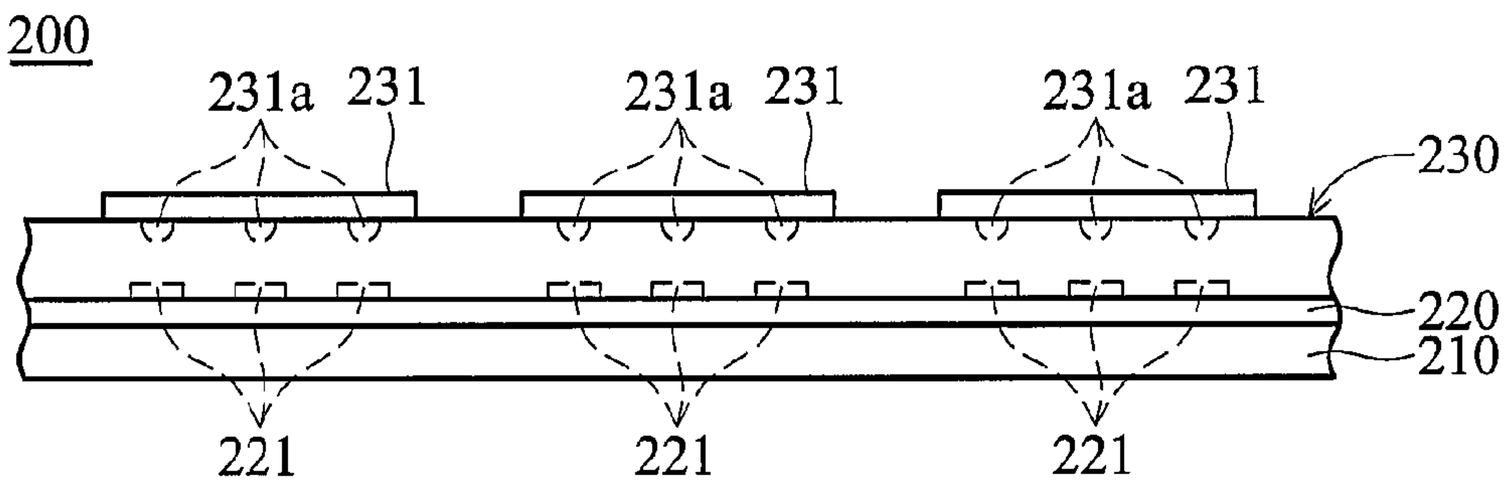

200
231a
231
231a
231
231a
231
230
220
210
221
221
221

FIG. 2A

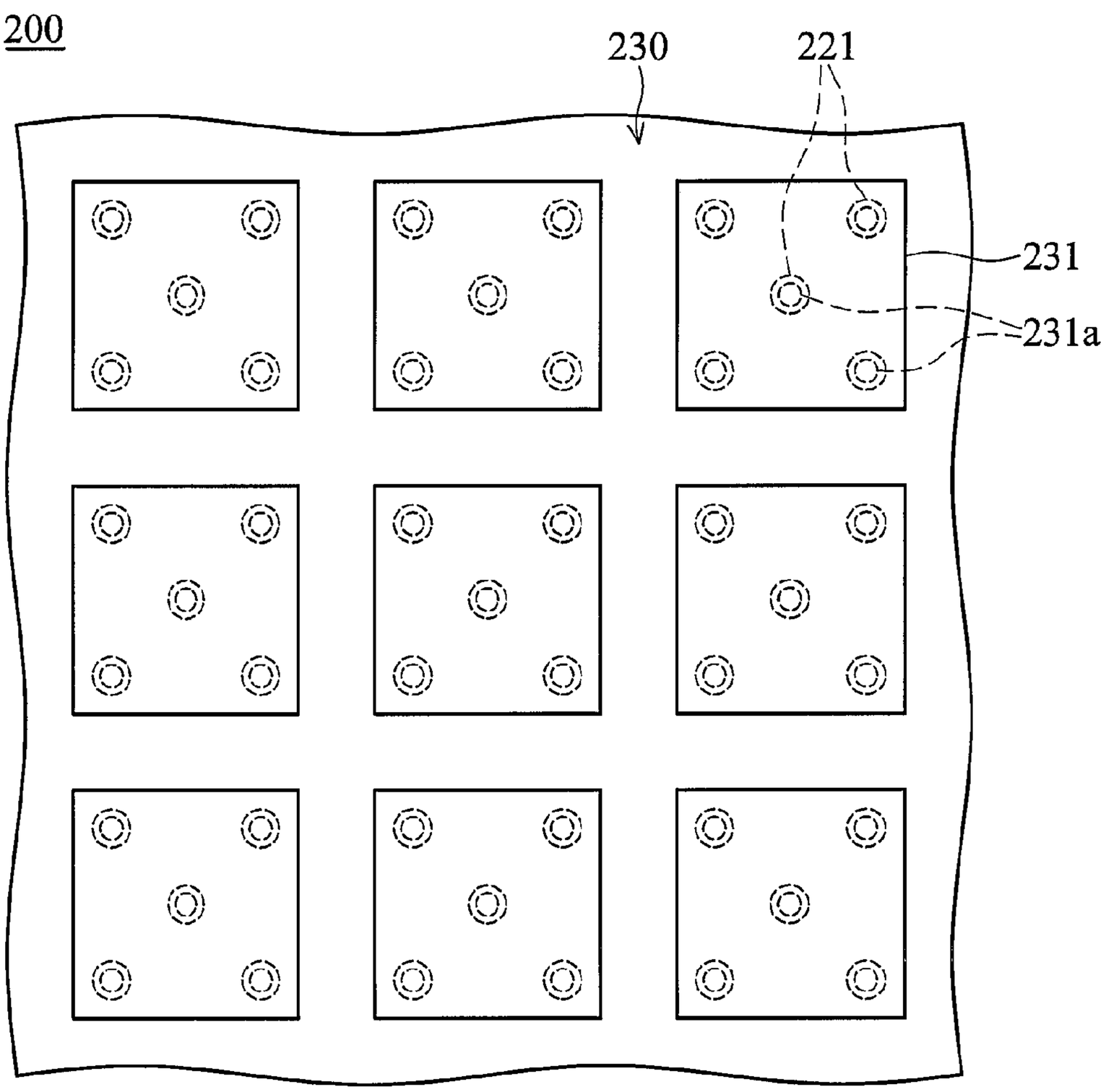

200
230
221
231
231a

FIG. 2B

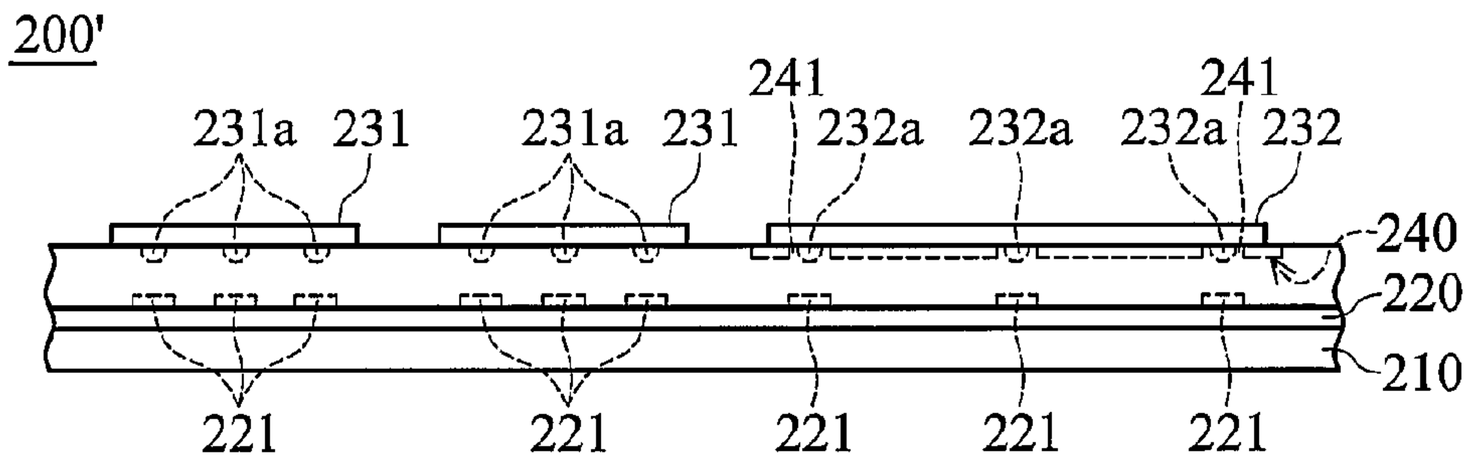

200'
241
241
231a
231
231a
231
232a
232a
232a
232
240
220
210
221
221
221
221
221

FIG. 3A

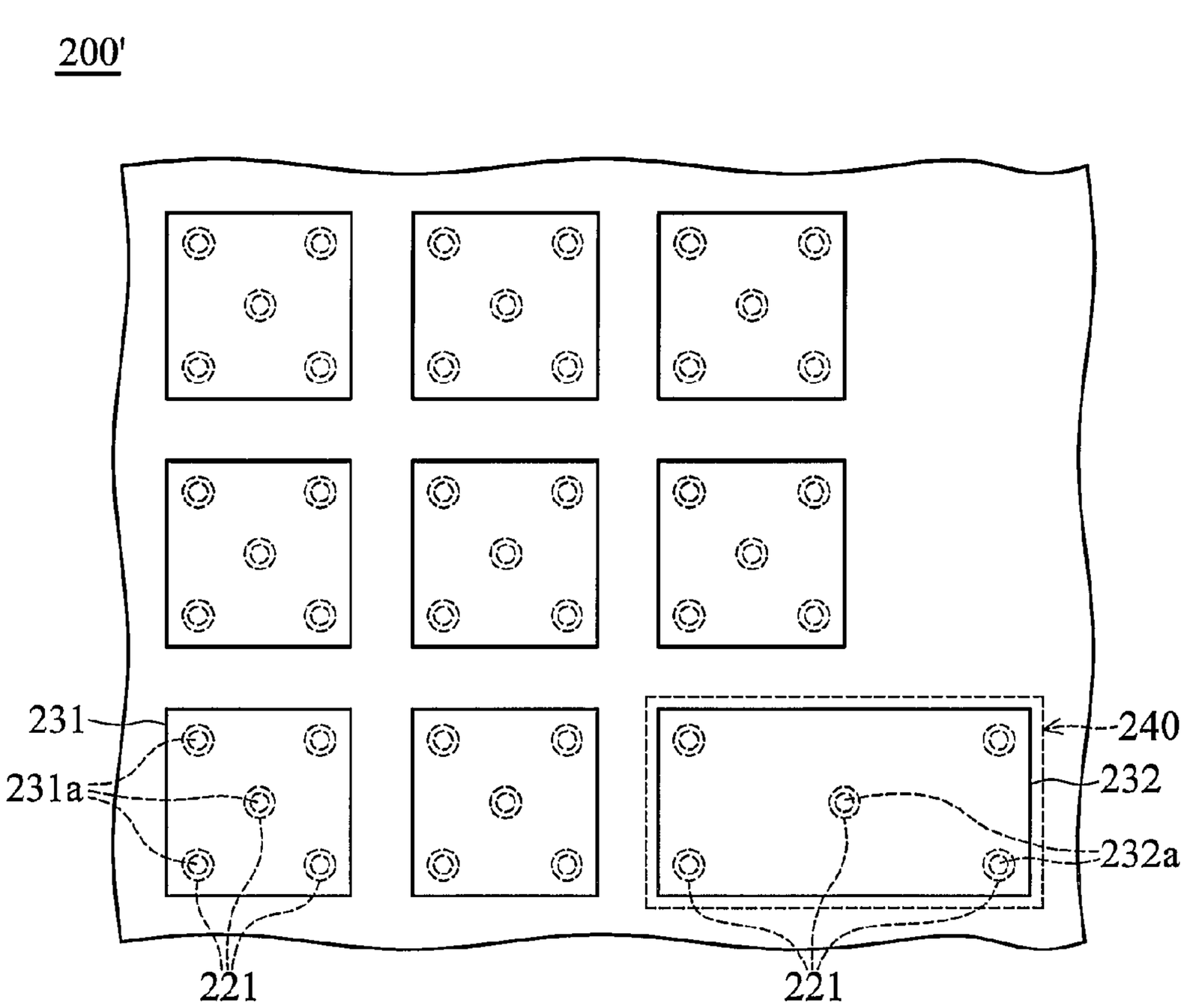

200'
231
231a
240
232
232a
221
221

FIG. 3B

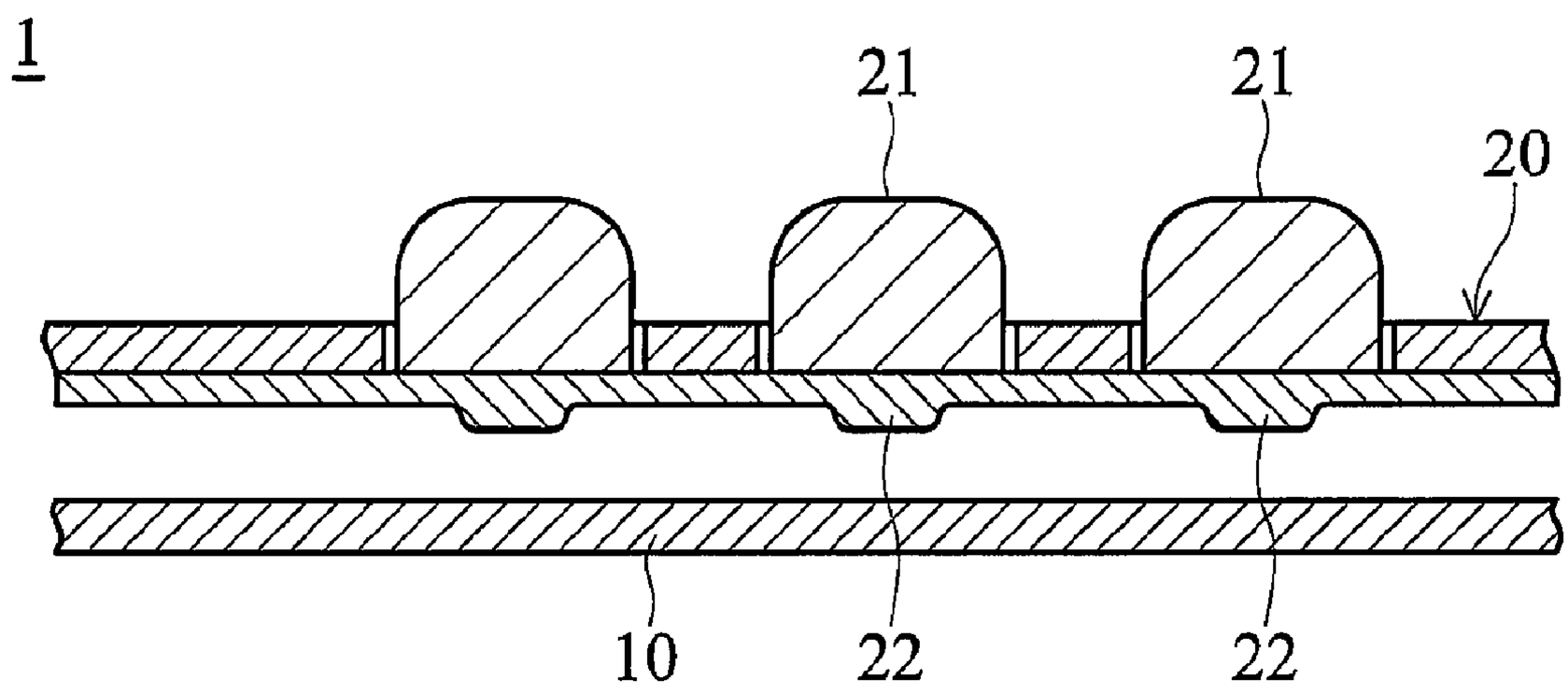


FIG. 4 (PRIOR ART)

KEYBOARDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to keyboards, and more particularly to keyboards providing enhanced operational sensitivity.

2. Description of the Related Art

A conventional key structure of a remote control comprises a keycap, a conductive elastomer, a switch (such as an edge connector), and a printed circuit board. The switch is disposed on the printed circuit board. The conductive elastomer is connected to the keycap and corresponds to the switch. An operator can press the keycap, forcing the conductive elastomer connected thereto to compress the switch. The switch is thus activated and outputs a corresponding signal.

Nevertheless, the conventional key structure has many drawbacks. To effectively activate the switch, the operator must press the center of the keycap. Specifically, when the operator presses corners of the keycap, the conductive elastomer often cannot compress the switch, causing ineffective operation of the key structure. Moreover, due to manufacturing considerations, the conventional key structure cannot provide waterproof and dustproof functions. Furthermore, the conductive elastomer often contains silicon oil. After long-term use, the conductive elastomer is easily broken and the silicon oil leaks from the interior thereof, causing damage to the entire key structure. Additionally, the conductive elastomer is expensive, such that the manufacturing costs of the key structure cannot be reduced.

Moreover, referring to FIG. **4**, a conventional key structure **1** comprises a circuit board **10** and a key assembly **20**. The key assembly **20** comprises multiple keys **21** and multiple protrusions **22**. Each protrusion **22** corresponds to each key **21** and is disposed thereunder. When one of the keys **21** is pressed, the protrusion **22** disposed thereunder compresses the circuit board **10**, outputting a corresponding signal.

Nevertheless, as the entire key assembly **20** often comprises soft material, power or kinetic energy from pressing the key **21** is offset by deformation of the key assembly **20**. Displacement of the corresponding protrusion **22** is insufficient and thus the protrusion **22** cannot exactly compress the circuit board **10**. Accordingly, the key **21** must be pressed again to function, causing inconvenience of operation. The aforementioned problem is particularly obvious with a multiple key.

Hence, there is a need for a keyboard providing soft tactile sensitivity for the operator and appropriate rigidity for efficient operation.

BRIEF SUMMARY OF THE INVENTION

A detailed description is given in the following embodiments with reference to the accompanying drawings.

An exemplary embodiment of the invention provides a keyboard comprising a membrane circuit board and at least one keycap. The membrane circuit board comprises a plurality of switches. The keycap is disposed on the membrane circuit board and comprises a plurality of activating pillars respectively corresponding to and separated from the switches. When the keycap is moved toward the membrane circuit board, the activating pillars compress the switches, outputting a signal corresponding to the keycap.

The keyboard further comprises at least one resilient member disposed between the keycap and the membrane circuit board and covering the switches and activating pillars.

The activating pillars are uniformly distributed over the keycap.

The activating pillars are distributed over the center and corners of the keycap, respectively.

The keycap comprises elastic material.

Another exemplary embodiment of the invention provides a keyboard comprising a membrane circuit board, a plurality of keycaps, and a reinforcement sheet. The membrane circuit board comprises a plurality of switches. The keycaps are disposed on the membrane circuit board and comprise elastic material. Each keycap comprises an activating pillar corresponding to each switch. One of the keycaps is provided with a multiple keycap. The reinforcement sheet is disposed between the multiple keycap and the membrane circuit board. The hardness of the reinforcement sheet exceeds that of the multiple keycap.

The keycap comprises rubber.

The reinforcement sheet comprises stiff plastic or metal.

The stiff plastic comprises PET.

The reinforcement sheet comprises a hole through which the activating pillar of the multiple keycap passes.

The reinforcement sheet is integrally formed with the multiple keycap by insert molding.

The reinforcement sheet is attached to the multiple keycap.

The multiple keycap comprises an Enter keycap, a Shift keycap, a Space keycap, or a Backspace keycap.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

FIG. **1**A is a partial side view of a keyboard of a first embodiment of the invention;

FIG. **1**B is a partial top view of the keyboard of the first embodiment of the invention;

FIG. **2**A is a partial side view of a keyboard of a second embodiment of the invention;

FIG. **2**B is a partial top view of the keyboard of the second embodiment of the invention;

FIG. **3**A is a partial side view of a keyboard of a third embodiment of the invention;

FIG. **3**B is a partial top view of the keyboard of the third embodiment of the invention; and

FIG. **4** is a schematic partial cross section of a conventional key structure.

DETAILED DESCRIPTION OF THE INVENTION

The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

First Embodiment

Referring to FIG. **1**A and FIG. **1**B, a keyboard **100** comprises a base plate **110**, a membrane circuit board **120**, a plurality of keycaps **130**, and a plurality of resilient members **140**.

The membrane circuit board **120** is disposed on the base plate **110** and comprises a plurality of switches **121**.

The keycaps **130** are disposed on the membrane circuit board **120**. Each keycap **130** comprises a plurality of activating pillars **131** respectively corresponding to and separated

from the switches **121**. Specifically, the disposition and number of the switches **121** of the membrane circuit board **120** correspond to those of the activating pillars **131** of the keycaps **130**. Moreover, the activating pillars **131** are uniformly distributed over each keycap **130**. More specifically, as shown in FIG. **1**B, the activating pillars **131** are distributed over the center and corners of each keycap **130**, respectively.

As shown in FIG. **1**A and FIG. **1**B, each resilient member **140** is disposed between each keycap **130** and the membrane circuit board **120** and covers the activating pillars **131** of each keycap **130** and the switches **121** corresponding thereto.

When a certain keycap **130** is pressed to move toward the membrane circuit board **120**, the pillars **131** compress the switches **121**, outputting a signal corresponding to the certain keycap **130**. On the other hand, after being released, the certain keycap **130** returns to an original position by resilience provided by a corresponding resilient member **140**.

Accordingly, uniformly distributed over each keycap **130** (or distributed over the center and corners of each keycap **130**, respectively), the activating pillars **131** thereof can compress the switches **121** of the membrane circuit board **120** even though the center thereof is not pressed (i.e. only corners of the keycap **130** are pressed), thereby outputting a signal corresponding thereto. Ineffective operation of the keyboard **100** is thus prevented. Namely, operational sensitivity of the keyboard **100** is effectively enhanced, such that the keyboard **100** can provide convenient and rapid operation.

Moreover, as each resilient member **140** covers the activating pillars **131** of each keycap **130** and the switches **121** corresponding thereto, external particles (such as, water and dusts) cannot enter a space between each keycap **130** and the membrane circuit board **120**. The keyboard **100** thus provides waterproof and dustproof functions.

Furthermore, the keyboard **100** omits conductive elastomers, thus providing reduced manufacturing costs and simplified assembly.

Additionally, the keyboard **100** provides extensive applicability. For example, the keyboard **100** can be applied as a remote control or a computer input device.

Second Embodiment

Referring to FIG. **2**A and FIG. **2**B, a keyboard **200** comprises a base plate **210**, a membrane circuit board **220**, and a key assembly **230**.

The membrane circuit board **220** is disposed on the base plate **210** and comprises a plurality of switches **221**.

The key assembly **230** is disposed on the membrane circuit board **220** and covers the switches **221** of the membrane circuit board **220**. Moreover, the key assembly **230** comprises a plurality of keycaps **231**. In this embodiment, the key assembly **230** comprises elastic material. Namely, the keycaps **231** comprise elastic material, such as rubber. Each keycap **231** comprises a plurality of activating pillars **231***a* respectively corresponding to and separated from the switches **221**. Specifically, the disposition and number of the switches **221** of the membrane circuit board **220** correspond to those of the activating pillars **231***a* of the keycaps **230**. Moreover, the activating pillars **231***a* are uniformly distributed over each keycap **231**. More specifically, as shown in FIG. **2**B, the activating pillars **231***a* are distributed over the center and corners of each keycap **231**, respectively.

When a certain keycap **231** is pressed to move toward the membrane circuit board **220**, the pillars **231***a* compress the switches **221**, outputting a signal corresponding to the certain keycap **231**. On the other hand, after being released, the certain keycap **231** returns to an original status by resilience itself.

Accordingly, uniformly distributed over each keycap **231** (or distributed over the center and corners of each keycap **231**, respectively), the activating pillars **231***a* thereof can compress the switches **221** of the membrane circuit board **220** even though the center thereof is not pressed (i.e. only corners of the keycap **231** are pressed), thereby outputting a signal corresponding thereto. Ineffective operation of the keyboard **200** is thus prevented. Namely, operational sensitivity of the keyboard **200** is effectively enhanced, such that the keyboard **200** can provide convenient and rapid operation.

Moreover, as the key assembly **230** covers the switches **221** of the membrane circuit board **220**, external particles (such as, water and dusts) cannot enter a space between the keycaps **231** and the membrane circuit board **220**. The keyboard **200** thus provides waterproof and dustproof functions.

Similarly, the keyboard **200** omits conductive elastomers, thus providing reduced manufacturing costs and simplified assembly.

Similarly, the keyboard **200** provides extensive applicability. For example, the keyboard **200** can be applied as a remote control or a computer input device.

Third Embodiment

Referring to FIG. **3**A and FIG. **3**B, a keyboard **200'** comprises a base plate **210**, a membrane circuit board **220**, a plurality of keycaps **231**, a plurality of keycaps **232**, and a plurality of reinforcement sheets **240** (FIG. **3**A and FIG. **3**B show only a keycap **232** and a reinforcement sheet **240** for simplicity of description).

The membrane circuit board **220** is disposed on the base plate **210** and comprises a plurality of switches **221**.

The keycaps **231** and **232** are disposed on the membrane circuit board **220** and comprise elastic material, such as rubber. In this embodiment, the keycaps **231** are common keycaps and the keycaps **232** are multiple keycaps, such as an Enter keycap, a Shift keycap, a Space keycap, and a Backspace keycap. Namely, the size of each keycap **232** exceeds that of each keycap **231**. Moreover, each keycap **231** comprises multiple activating pillars **231***a* and each keycap **232** comprises multiple activating pillars **232***a*. The position and number of the switches **221** of the membrane circuit board **220** correspond to those of the activating pillars **231***a* and activating pillars **232***a*. Namely, each activating pillar **231***a* or each activating pillar **232***a* corresponds to and is separated from each switch **221**.

Each reinforcement sheet **240** is disposed between each keycap **232** (multiple keycap) and the membrane circuit board **220** and comprises a plurality of holes **241** (as shown in FIG. **3**A) through which the activating pillars **232***a* of each keycap **232** (multiple keycap) respectively pass. Specifically, the hardness of the reinforcement sheets **240** exceeds that of the keycaps **232** (multiple keycaps). For example, the reinforcement sheets **240** may comprise stiff plastic (such as PET) or metal, such that the hardness of the reinforcement sheets **240** exceeds that of the keycaps **232** (multiple keycaps) comprising rubber. Moreover, each reinforcement sheet **240** may be attached to each keycap **232** (multiple keycap) or integrally formed with each keycap **232** (multiple keycap) by insert molding.

When the keycap **232** (multiple keycap) is pressed, the keycap **232** (multiple keycap) and reinforcement sheet **240** move toward the membrane circuit board **220**. The activating pillars **232***a* of the keycap **232** (multiple keycap) compress

the switches **221** of the membrane circuit board **220**, outputting a signal corresponding to the keycap **232** (multiple keycap).

Accordingly, as the rubber keycap **232** (multiple keycap) combined with the reinforcement sheet **240** provides enhanced rigidity, hard and soft tactile sensitivity can be obtained when an operator presses the keycap **232** (multiple keycap). Moreover, as the rubber keycap **232** (multiple keycap) combined with the reinforcement sheet **240** provides enhanced rigidity, the switches **221** of the membrane circuit board **220** can be exactly compressed when the keycap **232** (multiple keycap) is pressed, reducing inconvenience of operation. Additionally, as the reinforcement sheet **240** is disposed between the keycap **232** (multiple keycap) and the membrane circuit board **220**, aesthetical appearance of the keyboard **200'** is not adversely affected.

While the invention has been described by way of example and in terms of preferred embodiment, it is to be understood that the invention is not limited thereto. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A keyboard, comprising:

a membrane circuit board comprising a switch;

a keycap disposed on the membrane circuit board and comprising elastic material, wherein the keycap comprises an activating pillar corresponding to the switch; and

a reinforcement sheet disposed between the keycap and the membrane circuit board, wherein the hardness of the reinforcement sheet exceeds that of the keycap, when the keycap is pressed, the keycap and reinforcement sheet move toward the membrane circuit board and the activating pillar of the keycap compresses the switch of the membrane circuit board, outputting a signal corresponding to the keycap.

2. The keyboard as claimed in claim **1**, wherein the keycap comprises rubber.

3. The keyboard as claimed in claim **1**, wherein the reinforcement sheet comprises stiff plastic.

4. The keyboard as claimed in claim **3**, wherein the stiff plastic comprises PET.

5. The keyboard as claimed in claim **1**, wherein the reinforcement sheet comprises metal.

6. The keyboard as claimed in claim **1**, wherein the reinforcement sheet comprises a hole through which the activating pillar passes.

7. The keyboard as claimed in claim **1**, wherein the reinforcement sheet is attached to the keycap.

8. The keyboard as claimed in claim **1**, wherein the reinforcement sheet is integrally formed with the keycap by insert molding.

9. A keyboard, comprising:

a membrane circuit board comprising a plurality of switches;

a plurality of keycaps disposed on the membrane circuit board and comprising elastic material, wherein each keycap comprises an activating pillar corresponding to each switch, and one of the keycaps is provided with a multiple keycap; and

a reinforcement sheet disposed between the multiple keycap and the membrane circuit board, wherein the hardness of the reinforcement sheet exceeds that of the multiple keycap, when the multiple keycap is pressed, the multiple keycap and reinforcement sheet move toward the membrane circuit board and the activating pillar of the multiple keycap compresses the corresponding switch of the membrane circuit board, outputting a signal corresponding to the multiple keycap.

10. The keyboard as claimed in claim **9**, wherein the keycap comprises rubber.

11. The keyboard as claimed in claim **9**, wherein the reinforcement sheet comprises stiff plastic.

12. The keyboard as claimed in claim **11**, wherein the stiff plastic comprises PET.

13. The keyboard as claimed in claim **9**, wherein the reinforcement sheet comprises metal.

14. The keyboard as claimed in claim **9**, wherein the reinforcement sheet comprises a hole through which the activating pillar of the multiple keycap passes.

15. The keyboard as claimed in claim **9**, wherein the reinforcement sheet is integrally formed with the multiple keycap by insert molding.

16. The keyboard as claimed in claim **9**, wherein the reinforcement sheet is attached to the multiple keycap.

17. The keyboard as claimed in claim **9**, wherein the multiple keycap comprises an Enter keycap.

18. The keyboard as claimed in claim **9**, wherein the multiple keycap comprises a Shift keycap, a Space keycap, or a Backspace keycap.

* * * * *